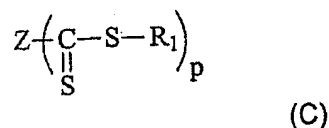
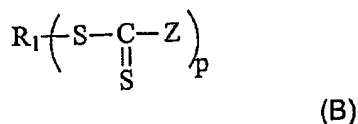
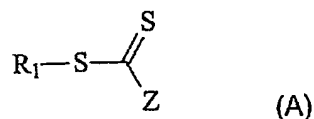


WHAT IS CLAIMED IS:

1. A process for partially or completely oxidizing one or more thiocarbonylthio ends of a polymer
5 resulting from a radical polymerization controlled by reversible addition-fragmentation using thiocarbonylthio agents which comprises a stage in which said polymer is brought into contact with an ozone-comprising gas, during which the ozone reacts with the
10 thiocarbonylthio end or ends.
2. The process as claimed in claim 1, characterized in that the ozone-comprising gas is air, helium, oxygen, argon, carbon dioxide, nitrogen or a mixture of
15 these gases.
3. The process as claimed in either one of claims 1 and 2, characterized in that the ozone-comprising gas comprises from approximately 0.01% by weight to
20 approximately 8% by weight of ozone, with respect to the total weight of gases.
4. The process as claimed in any one of claims 1 to 3, characterized in that the molar ratio of the
25 ozone to the thiocarbonylthio is between approximately 10 000:1 and approximately 1:100.
5. The process as claimed in claim 4, characterized in that the molar ratio of the ozone to the
30 thiocarbonylthio is between approximately 1000:1 and approximately 1:10.
6. The process as claimed in either one of claims 4 and 5, characterized in that the molar ratio of the
35 ozone to the thiocarbonylthio is between approximately 100:1 and approximately 1:1.
7. The process as claimed in any one of claims 1

to 6, characterized in that the thiocarbonylthio compound is a compound which can be of following formula (A), (B) or (C):



5

in which:

- Z represents:

- . a hydrogen atom,
 - . a chlorine atom,
 - 10 . an optionally substituted alkyl radical or an optionally substituted aryl radical,
 - . an optionally substituted heterocycle,
 - . an optionally substituted alkylthio radical,
 - . an optionally substituted arylthio radical,
 - 15 . an optionally substituted alkoxy radical,
 - . an optionally substituted aryloxy radical,
 - . an optionally substituted amino radical,
 - . an optionally substituted hydrazine radical,
 - . an optionally substituted alkoxycarbonyl radical,
 - 20 . an optionally substituted aryloxycarbonyl radical,
 - . a carboxyl or optionally substituted acyloxy radical,
 - . an optionally substituted aroyloxy radical,
 - . an optionally substituted carbamoyl radical,
 - . a cyano radical,
 - 25 . a dialkyl- or diaryl-phosphonato radical,
 - . a dialkyl-phosphinato or diaryl-phosphinato radical,
- or

- . a polymer chain,
 - R_1 represents:
 - . an optionally substituted alkyl, acyl, aryl, aralkyl, alkenyl or alkynyl group,
 - 5 . an optionally substituted, aromatic, saturated or unsaturated, carbon ring or heterocycle, or
 - . a polymer chain, and
 - p represents a number between 2 and 10.
- 10 8. The process as claimed in claim 7, characterized in that the thiocarbonylthio compounds are xanthate, dithiocarbamate, dithioester, dithiocarbamate or trithiocarbonate compounds.
- 15 9. The process as claimed in claim 8, characterized in that the compounds are xanthates.
10. The process as claimed in any one of claims 1 to 9, characterized in that the polymer comprises from
20 approximately 0.01% to approximately 35% by weight of thiocarbonylthio before contact with the ozone-comprising gas.
11. The process as claimed in any one of claims 1
25 to 10, characterized in that the polymer comprises from approximately 80% to 0% by weight of thiocarbonylthio with respect to the initial weight of thiocarbonylthio after contact with the ozone-comprising gas.
- 30 12. The process as claimed in any one of claims 1 to 11, characterized in that the polymer is a homopolymer or a copolymer of ethylenically unsaturated monomer(s).
- 35 13. The process as claimed in claim 12, characterized in that the ethylenically unsaturated monomers are monoethylenically unsaturated monomers chosen from:
 - styrene and styrene derivatives, such as α -methylstyrene or vinyltoluene,

- carboxylic acid vinyl esters, such as vinyl acetate, vinyl Versatate® or vinyl propionate,
- vinyl and vinylidene halides,
- unsaturated ethylenic mono- and dicarboxylic acids, such as acrylic acid, methacrylic acid, itaconic acid, maleic acid or fumaric acid, and the monoalkyl esters of the dicarboxylic acids of the type mentioned with alkanols preferably having 1 to 4 carbon atoms and their N-substituted derivatives,
- amides of unsaturated carboxylic acids, such as acrylamide, methacrylamide, N-methylolacrylamide, N-methylolmethacrylamide or N-alkylacrylamides,
- ethylenic monomers comprising a sulfonic acid group and its alkali metal or ammonium salts, for example vinylsulfonic acid, vinylbenzenesulfonic acid, α -acrylamidomethylpropanesulfonic acid or 2-sulfoethylene methacrylate,
- amides of vinylamine, in particular vinylformamide, vinylacetamide, N-vinylpyrrolidone and N-vinylcaprolactam,
- unsaturated ethylenic monomers comprising a secondary, tertiary or quaternary amino group or a heterocyclic group comprising nitrogen, such as, for example, vinylpyridines, vinylimidazole, aminoalkyl (meth)acrylates and aminoalkyl(meth)acrylamides, such as dimethylaminoethyl acrylate, dimethylaminoethyl methacrylate, di(tert-butyl)aminoethyl acrylate, di(tert-butyl)aminoethyl methacrylate, dimethylaminomethylacrylamide or dimethylaminomethylmethacrylamide, or zwitterionic monomers, such as, for example, sulfopropyl(dimethyl)aminopropyl acrylate,
- (meth)acrylic esters, such as glycidyl acrylate or glycidyl methacrylate,
- vinyl nitriles,
- monomers comprising at least one boronate functional group or one precursor, for example chosen from acryloylbenzeneboronic acid,

methacryloylbenzeneboronic acid, 4-vinylbenzeneboronic acid, 3-acrylamidophenylboronic acid or 3-methacrylamidophenylboronic acid, alone or as mixtures, or in the form of salts,

5 - monomers comprising phosphonates, for example chosen from N-methacrylamidomethylphosphonic acid ester derivatives, in particular the n-propyl ester (RN 31857-11-1), the methyl ester (RN 31857-12-2), the ethyl ester (RN 31857-13-3), the

10 n-butyl ester (RN 31857-14-4) or the isopropyl ester (RN 51239-00-0), and their phosphonic monoacid and diacid derivatives, such as N-methacrylamidomethylphosphonic diacid (RN 109421-20-7); N-methacrylamidoethylphosphonic acid

15 ester derivatives, such as N-methacrylamidoethylphosphonic acid dimethyl ester (RN 266356-40-5) or N-methacrylamidoethylphosphonic acid di(2-butyl-3,3-dimethyl) ester (RN 266356-45-0), and their phosphonic monoacid and diacid derivatives, such

20 as N-methacrylamidoethylphosphonic diacid (RN 80730-17-2); N-acrylamidomethylphosphonic acid ester derivatives, such as N-acrylamidomethylphosphonic acid dimethyl ester (RN 24610-95-5), N-acrylamidomethylphosphonic acid diethyl ester

25 (RN 24610-96-6) or bis(2-chloropropyl) N-acrylamidomethylphosphonate (RN 50283-36-8), and their phosphonic monoacid and diacid derivatives, such as N-acrylamidomethylphosphonic acid (RN 151752-38-4); the vinylbenzylphosphonate dialkyl ester

30 derivatives, in particular the di(n-propyl) (RN 60181-26-2), di(isopropyl) (RN 159358-34-6), diethyl (RN 726-61-4), dimethyl (RN 266356-24-5), di(2-butyl-3,3-dimethyl) (RN 266356-29-0) and di(t-butyl) (RN 159358-33-5) ester derivatives,

35 and their phosphonic monoacid and diacid alternative forms, such as vinylbenzylphosphonic diacid (RN 53459-43-1); diethyl 2-(4-vinylphenyl)ethanephosphonate (RN 61737-88-0); dialkylphosphonoalkyl acrylate and methacrylate

derivatives, such as 2-(acryloyloxy)ethylphosphonic acid dimethyl ester (RN 54731-78-1) and 2-(methacryloyloxy)ethylphosphonic acid dimethyl ester (RN 22432-83-3), 2-(methacryloyloxy)methylphosphonic acid diethyl ester (RN 60161-88-8), 2-(methacryloyloxy)methylphosphonic acid dimethyl ester (RN 63411-25-6), 2-(methacryloyloxy)propylphosphonic acid dimethyl ester (RN 252210-28-9), 2-(acryloyloxy)methylphosphonic acid diisopropyl ester (RN 51238-98-3) or 2-(acryloyloxy)ethylphosphonic acid diethyl ester (RN 20903-86-0), and their phosphonic monoacid and diacid alternative forms, such as 2-(methacryloyloxy)ethylphosphonic acid (RN 80730-17-2), 2-(methacryloyloxy)methylphosphonic acid (RN 87243-97-8), 2-(methacryloyloxy)propylphosphonic acid (RN 252210-30-3), 2-(acryloyloxy)propylphosphonic acid (RN 254103-47-4) and 2-(acryloyloxy)ethylphosphonic acid; vinylphosphonic acid, optionally substituted by cyano, phenyl, ester or acetate groups, vinylidenephosphonic acid, in the sodium salt form or the form of its isopropyl ester, or bis(2-chloroethyl)vinylphosphonate, it being possible for these monomers comprising a phosphonic mono- or diacid functional group to be used in the partially or completely neutralized form, optionally neutralized by an amine, for example dicyclohexylamine,

- monomers chosen from the phosphate analogs of the phosphonate-comprising monomers described above, the monomers then comprising a -C-O-P- sequence in comparison with the -C-P- sequence of the phosphonates, and

- monomers carrying an alkoxysilane group chosen from

| | |
|----------------------------|---------------|
| trimethoxysilylpropyl | methacrylate, |
| triethoxysilylpropyl | methacrylate, |
| tributoxysilylpropyl | methacrylate, |
| dimethoxymethylsilylpropyl | methacrylate, |
| diethoxymethylsilylpropyl | methacrylate, |

- dibutoxymethylsilylpropyl methacrylate,
diisopropoxymethylsilylpropyl methacrylate,
dimethoxysilylpropyl methacrylate,
diethoxysilylpropyl methacrylate, dibutoxysilyl-
5 propyl methacrylate, diisopropoxysilylpropyl
methacrylate, trimethoxysilylpropyl methacrylate,
triethoxysilylpropyl methacrylate, tributoxy-
silylpropyl methacrylate, trimethoxysilylpropyl
acrylate, triethoxysilylpropyl acrylate,
10 tributoxysilylpropyl acrylate, dimethoxymethyl-
silylpropyl acrylate, diethoxymethylsilylpropyl
acrylate, dibutoxymethylsilylpropyl acrylate,
diisopropoxymethylsilylpropyl acrylate, dimethoxy-
silylpropyl acrylate, diethoxysilylpropyl
15 acrylate, dibutoxysilylpropyl acrylate, diiso-
propoxysilylpropyl acrylate, trimethoxysilylpropyl
acrylate, triethoxysilylpropyl acrylate or
tributoxysilylpropyl acrylate, or their mixture.
- 20 14. The process as claimed in either one of claims 12
and 13, characterized in that the ethylenically
unsaturated monomers are chosen from styrene monomers,
vinyl esters, neutral or charged hydrophilic acrylates,
hydrophobic acrylates, neutral or charged hydrophilic
25 methacrylates, hydrophobic methacrylates, hydrophilic
or hydrophobic and neutral or charged acrylamido
derivatives, hydrophilic or hydrophobic and neutral or
charged methacrylamido derivatives, or their mixtures.
- 30 15. The process as claimed in claim 12, characterized
in that a fraction of the ethylenically unsaturated
monomers are chosen from polyethylenically unsaturated
monomers.
- 35 16. The process as claimed in claim 15, characterized
in that the polyethylenically unsaturated monomer
comprises at least two ethylenic unsaturations and at
most 10 ethylenic unsaturations.

17. The process as claimed in claim 16, characterized in that the polyethylenically unsaturated monomer comprises two or three ethylenic unsaturations.

5 18. The process as claimed in any one of claims 15 to 17, characterized in that the polyethylenically unsaturated monomer is chosen from acrylic, methacrylic, acrylamido, methacrylamido, vinyl ester, vinyl ether, diene, styrene, α -methylstyrene and allyl
10 derivatives.

19. The process as claimed in any one of claims 15 to 18, characterized in that the polyethylenically unsaturated monomer additionally comprises one or more
15 functional groups other than ethylenic unsaturations chosen from the hydroxyl, carboxyl, ester, amide, amino, substituted amino, mercapto, silane, epoxy or halo functional groups.

20 20. The process as claimed in any one of claims 15 to 19, characterized in that the polyethylenically unsaturated monomer is chosen from divinylbenzene and divinylbenzene derivatives, vinyl methacrylate, methacrylic acid anhydride, allyl methacrylate,
25 ethylene glycol dimethacrylate, phenylene dimethacrylate, diethylene glycol dimethacrylate, triethylene glycol dimethacrylate, tetraethylene glycol dimethacrylate, polyethylene glycol 200 dimethacrylate, polyethylene glycol 400 dimethacrylate, 1,3-butanediol
30 dimethacrylate, 1,4-butanediol dimethacrylate, 1,6-hexanediol dimethacrylate, 1,12-dodecanediol dimethacrylate, 1,3-glycerol dimethacrylate, diurethane dimethacrylate or trimethylolpropane trimethacrylate; vinyl acrylate, bisphenol A epoxy diacrylate,
35 dipropylene glycol diacrylate, tripropylene glycol diacrylate, polyethylene glycol 600 diacrylate, ethylene glycol diacrylate, diethylene glycol diacrylate, triethylene glycol diacrylate, tetraethylene glycol diacrylate, neopentyl glycol

ethoxylate diacrylate, butanediol diacrylate,
hexanediol diacrylate, aliphatic urethane diacrylate,
trimethylolpropane triacrylate, trimethylolpropane
ethoxylate triacrylate, trimethylolpropane propoxylate
5 triacrylate, glycerol propoxylate triacrylate,
aliphatic urethane triacrylate, trimethylolpropane
tetraacrylate or dipentaerythritol pentaacrylate; vinyl
crotonate, diethylene glycol divinyl ether,
1,4-butanediol divinyl ether or triethylene glycol
10 divinyl ether; diallyl phthalate, diallyl-
dimethylammonium chloride, diallyl maleate, sodium
diallyloxyacetate, diallylphenylphosphine, diallyl
pyrocarbonate, diallyl succinate, N,N'-diallyl-
tartardiamide, N,N'-diallyl-2,2,2-trifluoroacetamide,
15 the allyl ester of diallyloxyacetic acid,
1,3-diallylurea, triallylamine, triallyl trimesate,
triallyl cyanurate, triallyl trimellitate or 1,3,5-tri-
allyltriazine-2,4,6(1H,3H,5H)-trione; N,N'-methylene-
bisacrylamide, N,N'-methylenebismethacrylamide,
20 glyoxalbisacrylamide or diacrylamidoacetic acid;
divinylbenzene and 1,3-diisopropenylbenzene; butadiene,
chloroprene or isoprene.

21. The process as claimed in any one of claims 15
25 to 20, characterized in that the polyethylenically
unsaturated monomer is chosen from N,N'-
methylenebisacrylamide, divinylbenzene, ethylene glycol
diacrylate or trimethylolpropane triacrylate.

30 22. The process as claimed in any one of claims 1 to
8, characterized in that the molar fraction of
polyethylenically unsaturated monomers with respect to
the monoethylenically unsaturated monomers is between
0.001 and 1.

35

23. The process as claimed in any one of claims 1
to 22, characterized in that the polymer is in solution
in an aqueous or organic solvent.

24. The process as claimed in any one of claims 1 to 22, characterized in that the polymer is in dispersion in water or a solvent or a mixture of solvents.

5

25. The process as claimed in any one of claims 1 to 22, characterized in that the polymer is in aqueous emulsion (latex).

10 26. The process as claimed in claim 24, characterized in that the particle size of the dispersion is between approximately 10 and approximately 50 000 nanometers.

15 27. The process as claimed in claim 25, characterized in that the particle size of the aqueous emulsion is between approximately 10 and approximately 500 nanometers.

20 28. The process as claimed in any one of claims 1 to 27, characterized in that the polymer is brought into contact with the ozone countercurrentwise.

29. A polymer capable of being obtained by the process as claimed in any one of claims 1 to 28.